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NOTES UPON LOGICAL TOPICS

I. A CLASSIFICATION OF CONTEMPORARY TENDENCIES[1]

IT is an interesting example of the irony of history that it was Kant who remarked, about a century and a quarter ago, that since Aristotle logical theory has neither lost nor gained an inch—that it appeared complete and settled. To-day the greatest difficulty students of logic have to contend with is the variety of independent and specialized points of view, a variety so great that it is almost impossible for any one person to be at home in all of them, independently of the diversity of opinion found in any one of them. A rough attempt to catalogue these various points of view and tendencies, even when undertaken by one quite ignorant in some of the fields, may be of use at least in defining some problems which are pressing in the further development of logic. Accordingly, a rough scheduling of tendencies follows.

1. *Formal Logic.*—The logic of scholastic tradition. It was, of course, formal logic which Kant, wrongly ascribing to Aristotle, regarded as finished and settled. But Kant's very insistence upon the purely formal character of thinking as such—his insistence that pure logic has nothing to do with any of the objects or contents of knowledge, being confined to analytic consistency with reference to identity and non-contradiction, was one of the chief forces in calling out by reaction other conceptions of logic.[2] The more rigorously one carries out the program of excluding from logical theory all reference to truth, belief and the evidential value of data, the more

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[1] I am glad to take advantage of the foundation of a publication of this type to record notes which are too informal to justify publication in more finished shape, and yet which, as notes of a student, may be of some use to other students of the same subject.

[2] See, for example, how Hamilton and Mansel, who followed Kant in applying logic to formal laws of thinking, evoked the reaction of Mill on the one side, and of T. H. Green on the other. Mill, 'An Examination of Sir William Hamilton's Philosophy,' 1865, and T. H. Green, 'Works,' Vol. II., 'Logic of the Formal Logicians.' (Lectures delivered in 1874–5.)

apparent the emptiness of such logic becomes, and the more the mind seeks for some other conception of thought to serve as a basis for logic of another type.

2. *Empirical Logic.*—Hence it was inevitable that when the rationalistic school went to seed in its doctrine of a purely empty thinking process, empiricism strove to build up a constructive logic of 'experience' as a source and guarantee of practical and scientific truths. John Stuart Mill was, of course, explicit in teaching that true logic is concerned with adequacy of evidence and proof, with the validating and discrediting of belief—with, in a word, all the processes which have to do with the consideration of any truth which is not self-evident. Rarely has any piece of intellectual work met so fully the need which called it out, and imposed itself so overmasteringly upon its generation, as did the logic of Mill. The empiricist, since Mill, repeats by his actions, if not by his words, what Kant said of Aristotle, that logic is henceforth complete and settled.[3]

The tendency of current textbooks to incorporate within themselves both the formal and the empirical logics, as if they simply amicably divided the field between them, is a good illustration of the capacities of the human mind. The assumption that thought has a deductive and an inductive process, which work by different laws, and that the formal, syllogistic logic adequately describes the deductive function, while the empirical logic as adequately represents the inductive, furnishes as striking an instance as one could find of the catholic willingness of the human mind to accommodate itself even to diametrically opposite assumptions provided that will save the trouble of systematic, reconstructive thinking.

3. *Real Logic.*—I use this term not as assuming that this sort of logical theory is 'real,' while others are artificial, but as a phrase, in the absence of any commonly recognized designation, with which to refer to those tendencies which give thought itself a content, and which reach their limit in the assumption that truth itself is just the perfected content of thought. The irony of history, to which I alluded at the outset, is, of course, the fact that it was Kant's transcendental logic which brought to an end the settled and fixed condition he attributed to logic. His so-called transcendental logic was nothing more nor less than an attempt to show the positive part played by thought in the determination of any experience which is capable of having attributed to itself the distinctions of truth and falsity.

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[3] Nevertheless, the work of John Venn, 'Principles of Empirical or Inductive Logic,' London, 1889, is such an independent rendering of Mill as to be worthy of more attention than it receives in the current Teutophile philosophy.

Under this head come all who have been positively influenced by the Kantian theory of judgment as involving an objective synthesis, possible only through certain thought functions. It is a term, therefore, which has to be applied largely by way of contrast. It includes almost all those who do not believe in the purely formal notion of thought, and yet are unwilling to accept empiricism. It names certain tendencies rather than any very homogeneous or defined body of thought. To take some of the best known writers, the names of Bradley, Bosanquet, Lotze, Sigwart and Wundt would all appear here, much as they differ from one another.

These three captions refer to movements that are sufficiently well defined to be termed schools of logical thought. They represent, that is to say, intellectual standpoints which have become sufficiently conscious of themselves to get formulation, and to be aware of their incompatibilities with one another. The tendencies that I am about to schedule are rather just tendencies. They are forces at work rather than schools of doctrine. Consequently, they are not necessarily incompatible either with one another or in all respects with the three tendencies just mentioned.

4. Attempts to reform the traditional syllogistic and inductive logics so as to bring them into greater accord with 'common sense' and with the methods and results of scientific inquiry. Such attempts, in the main, start from the accepted terminology of logical theory and try to free it from those connotations which attach to it in virtue of either the scholastic or the empirical standpoints; and to show how, without accepting any particular philosophical standpoint, logical conceptions must be interpreted in order to meet the working logic of practical life, and of scientific investigation and verification. To my mind the best representative of this tendency is Professor Alfred Sidgwick, and as I hope to devote one of my later notes specially to his reformatory work, I shall say nothing more about it here.

5. *Mathematical Logic.*—Under this head two tendencies are to be noted. One is the disposition to interpret and to construct logic as mathematics, and the other to build up the system of mathematical science as itself the adequate representative of logic. Most systems of symbolic logic illustrate the former. By the latter I mean the work which has been done primarily by mathematicians as mathematicians under the conception that mathematical science is in no sense limited by the concept of quantity, but has to do with all reasoning which may be exhibited in necessary form or that deals with necessary conclusions. I am not enough of a mathematician to characterize this movement closely, but I am sure I am not far out of the way in referring to the work of Benj. Pierce, and of the recent

Italian school of Peano as typical examples. I suppose this strictly logical tendency has been much more influential in building up the hyperspace geometry and the modern theory of numbers than the layman recognizes. In our present condition of specialization it is somewhat difficult for one and the same person to be well posted on the more general and philosophical aspects of logical theory, and at the same time to be at home in the recent development of scientific mathematics. I am inclined to believe that a person who should be properly equipped on both sides, and who was also at home in recent psychology, could render the logic of reasoning a very great service. Professor Royce has already given us some tantalizing specimens of what is possible in this direction.[4]

Among those who are interested in logic from the mathematical side there seems to be a further division of tendency. One school seems explicitly or implicitly to hold by the traditional formal logic, and to be engaged in making it more rigorous by the use of symbols, thus carrying out the program of more strict formalism, eliminating ambiguities arising from context and putting the formulæ of logic into a more compact and sequential form.

But, on the other hand, Mr. C. S. Peirce (if I interpret him aright) believes that one of the chief advantages of the mathematical, or symbolic statement is that logic may transcend thereby the limitations of mere formalism and become a potent instrumentality in developing a system which has inherent reference to the pursuit of truth and the validation of belief.

6. *Psychological Logic.*—Without in any way prejudging in advance the question as to whether logic and psychology are independent disciplines which can be brought into contact with each other only at the risk of corruption to both, one may note the fact that there is a renaissance of interest in the psychology of the reflective processes. This psychological development is giving at once such a novel and such a significant interpretation of the nature of thought in general, and of its various phenomena in particular, that it is hard to see how it can continue without in time affecting somewhat profoundly the consideration of strictly logical problems. If, for example, psychologists should come to a pretty definite consensus that thinking is originally conditioned by inhibited and, therefore, postponed action, it would seem as if such a view could not fail to modify the details of logical theory. Professor James's identification of

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[4] I refer especially to parts IV. and V. of the second chapter of his 'World and the Individual,' Second Series, and to his presidential address upon 'Recent Logical Inquiries,' *The Psychological Review*, Vol. IX., p. 105. I do not include his supplementary essay in the first volume of his 'World and the Individual,' because he has (unfortunately, it seems to me) given his interpretation an ontological rather than a logical turn.

abstraction with a selective function, taking place on the basis of interest, which runs through all psychical processes whatsoever, and his theory of the teleological nature of conception, if accepted in psychology, can hardly fail to carry with them some kind of moral for logic. And, to take an instance that is seemingly somewhat more remote from logic proper, his conception of the stream of consciousness as involving a rhythm of substantive and transitive sort, and of carrying with it necessarily a certain relationship between the more or less definite (or, what is the same thing, the more or less vague) must be either true or false in psychology—and if true in psychology must modify in some way or other the conception of thought that obtains in logic.

7. *Logic in Connection with Comparative and General Grammar.* —It goes without saying that logic in its beginnings, logic at the hands of Plato and Aristotle, went along with and was largely dependent upon an analysis of the sentential structures in which thought is embodied. Logic more than repaid what it borrowed from its analysis of language fixing the categories of grammar and language study for many centuries. The science of language had practically no independent existence, but was a mode of phrasing the recognized distinctions of classic logical theory. But, as every one knows, within the last hundred years the study of language has entered upon an independent development of its own, and has now practically shaken itself free from the incubus of its externally imposed categories, which in turn originated from a more superficial study of linguistic phenomena. The time has about come, I think, when logic may again borrow from the extensive and profound analysis of language in as significant and important a way as the logic of Aristotle borrowed from the narrow and obvious language data at command.

Up to the present those who have attempted to make the connections between general grammar and logic have, for the most part, been already committed to a certain psychology. I do not wish to be ungrateful to the services rendered by Steinthal and his followers, but it seems to me, nevertheless, true that their efforts have been very much compromised (and this is true also in some degree, I should say, of Wundt) by the attempt to fit the results of philology into the *cadres* of a preexistent psychology, the Herbartian. The situation will be more promising in the degree in which students of language, working freely with their own data, and using psychology only as a working tool, make their own logical renderings and translations. It would not be difficult to gather from modern grammarians of the comparative and historical schools, a large body of data of great significance for the logical theory of propositions and terms—that is, of judgment and ideas.

8. *Logic and Scientific Methods.*—Of course, the status of scientific method has always had reflex influence upon logic; but in the main this has taken effect in the past through the efforts of those who were already logicians in utilizing the methods of experimental science in connection with the building up of their own systems. Without ignoring the tremendous fluctuation that has come to logic from such endeavors, we may expect, I think, still more fertilization when scientific men undertake an independent statement of the logical bearings of their own modes of procedure. We clearly are entering upon this stage of development. It is necessary only to refer to such names as Poincaré, Boltzmann and Mach.

JOHN DEWEY.

THE UNIVERSITY OF CHICAGO.

THE NECESSITY FROM THE STANDPOINT OF SCIENTIFIC METHOD OF A RECONSTRUCTION OF THE IDEAS OF THE PSYCHICAL AND THE PHYSICAL

SCIENCE is the attempt to give a rational explanation of the universe. Its earliest systematic statement is that of the so-called physical sciences—astronomy, physics, chemistry—in which the world is interpreted in purely mechanical terms. Nature is a mechanism. The concepts with which science operates in this stage are matter and motion. The material units, atoms, which make up the universe, are in constant movement. There is an extended substance, and this substance is in process of universal change. Ultimately, reality consists simply of atoms and their movements. There may be all sorts of combinations of these atoms; they may stand in all sorts of relations by reason of their ceaseless change; but ultimately there is conceived to be a substance, called matter, lying back of the changes. Matter is the permanent core of reality which runs through the changes, which underlies the movements of the atoms and makes them possible. This is the philosophical postulate of the earliest scientific physics—the existence of matter in motion. Inasmuch as matter is made fundamental in the conception, and this matter is conceived as given in little bits or units called atoms, this may be called the static conception of the universe, the lump theory of reality. The view has been held by mechanical scientists and philosophers from the time of Democritus. And it must be said that great fundamental principles have been established from this standpoint, which more recent science has restated rather than overthrown.